1,153,543

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Spinneret Plate for Producing Filaments of Non-Circular Cross-Section and Filaments produced therewith

We, SNAM PROGETTI S.p.A., an Italian Company, of No. 16 Corso Venezia, Milan, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a spinneret plate for use in melt-spinning filaments of non-circular cross-section, and to a filament having a non-circular cross-section produced therewith.

Processes are known for obtaining filaments which have non-circular cross-sections and which have a lustre higher than that of filaments having a circular cross-section, both before and after dyeing, as well as other improved physical properties such as resilience and hand.

Such known processes employ extrusion orifices in the spinneret plates, which instead of being of circular cross-section are slot-shaped and have a cross-section in the form of one or more lengthened or rounded branches radiating from the same point or from the sides of a slot having the form of an almost completed polygon.

The filaments produced by such spinneret plates have a cross-section which is more or less like that of the orifices, depending on the melt-spinning conditions and the characteristics of the extruded polymer.

Such filaments have as many lobes as there are branches of the orifices and in filaments produced in such a way the exterior surface of the filament is increased and this results in the filament having a greater lustre, as well as in improvements in other physical properties.

However, filaments having such symmetrical lobes prevent close contact between different filaments in a multi-filament product. In fact the lobes of one filament arranged parallel to other filaments to give a multi-filamentary yarn are not well accommodated in the corresponding recesses between lobes of adjacent filaments.

We have now found that satisfactory accommodation of the lobes of one filament in the recesses of an adjacent filament in a multi-filament may be obtained when employing spinnerets having extrusion orifices of a particular cross-section.

According to one aspect of the present invention, there is provided a spinneret plate for use in melting-spinning filaments of non-circular cross-section, comprising a plurality of slot-shaped extrusion orifices having a cross-section in the form of a straight central portion each end of which either merges into a curved portion, the curved portions being curved in opposite directions, of is joined to and in communication with another straight portion angled with respect to the central portion, the terminal straight portions pointing in opposite directions.

The cross-section of the orifice is the one taken in a plane parallel to the extrusion face of the spinneret plate.

According to another aspect of the present invention, there is provided a filament having a cross-section in the form of straight central portion each end of which either merges into a curved portion, the curved portions being curved in opposite direction, or is joined to and in communication with another straight portion angled with respect to the central portion, the terminal straight portions pointing in opposite directions.

According to a further aspect of the present invention, there is provided a process for producing melt-spun filaments of non-circular cross-section, which includes the step of ex-

truding a melt-spinnable material through a spinneret plate of the invention.

In the case in which the cross-section of the extrusion orifice is in the form of a straight central portion and two curved terminal portions, the cross-section of the orifice, and consequently that of the filament extruded from the orifice, may be in the form of an S.

It will be appreciated that the cross-section of the extrusion orifice determines the cross-section of the filament extruded from the orifice and therefore it is to be understood that preferred filaments are those produced by extrusion through orifices of preferred cross-sections.

In the case in which the cross-section of the extrusion orifice is in the form of a straight central and straight terminal portions, the length of the central portion is preferably greater than the length of either terminal portion of the same extrusion orifice.

It is also preferable for the angle between the straight central and straight terminal portion to be from 15 to 150°, particularly from 60 to 150°.

Another preferred cross-section for the extrusion orifice is one in which the two terminal straight portions are parallel to each other.

At least two of the extrusion orifices may be either similarly orientated or disorientated with respect to an imaginary line connecting their centres.

The cross-section of the filaments obtained by extrusion through the spinneret plates of the invention allows good mutual accommodation of the lobes of filaments within the recesses between the lobes of adjacent filaments.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawing, in which:

Figures 1, 2, 3 and 4 represent different cross-sections of extrusion orifices used in the spinneret plate of the invention; and

Figure 5 represents a cross-section of a plurality of filaments produced by extrusion through a spinneret plate of the invention.

Referring now to Figures 1, 3 and 4 of the drawing, it can be seen that in each of these embodiments the length of the central straight portion is greater than the length of either of the terminal portions.

Figure 5 shows the close mutual engagement of the filaments of the invention.

The following illustrative Examples describe the preparation and spinning of filaments of the invention.

EXAMPLE 1.

A spinneret plate with twenty extrusion orifices shaped as in Fig. 1 was employed in the spinning of transparent polyethylene terephthalate having an intrinsic viscosity of 0.67 to form lobed filaments having a high lustre.

The spinning head was kept at 290° C. and the wind-up speed was 350 m./min. The stretching was carried out cold in a conventional stretching-twisting apparatus and the resulting filament possessed the following characteristics after stretching:

—filament denier: 70/20
—tensile strength: 4.20 gr./den.
—elongation: 12.5%

The cross-section of the resulting filament was similar to that represented in Fig. 5.

EXAMPLE 2.

The same spinneret plate as was used in Example 1 was employed in the spinning of polyethylene terephthalate having an intrinsic viscosity of 0.68. The temperature of the spinning head was kept at 290° C. and the wind-up speed was 300 m/min. with an unstretched filament denier of 280.

The unstretched filaments were collected together in a single 120,000 denier tow and the stretching was carried out conventionally in two steps with a final stretching ratio of 3.5. The tow was crimped by employing an apparatus operating as a compression chamber. In such a way a tow with a low crimping (2—3 waves/cm.) as well as other good characteristics was obtained. The tow was then subjected in sequence to a first-finishing a washing, a crimping stabilization and to another finishing suitable for subsequent treatments. The tow was then cut.

The more important characteristics of the tow as are follows:

—tow denier: 4.2
—crimping frequency: 2.77 waves/cm.
—length: 90 mm.
—tensile strength: 3.93 gr./denier
—elongation: 51%

The tow was then carded, split into three, combed, split again into three, further prepared for spinning and the led to the spindle rail and finally to the ring.

Two yarns having a twisting and respectively a nominal count of Nm 24 and Nm 34, suitable for knitting and weaving were obtained. The term "Nm" indicates the number of metres per gram of yarn.

WHAT WE CLAIM IS:—

1. A spinneret plate for use in melt-spinning filaments of non-circular cross-section, comprising a plurality of slot-shaped extrusion orifices having a cross-section in the form of a straight central portion each end of which either merges into a curved portion, the curved portions being curved in opposite directions, or is joined to and in communication with another straight portion angled with respect to the central portion, the termi-

nal straight portions pointing in opposite directions.

2. A spinneret plate for use in melt-spinning filaments of non-circular cross-section, comprising a plurality of slot-shaped extrusion orifices having a cross-section in the form of a straight central portion each end of which merges into a curved portion, the curved portions being curved in opposite directions.

3. A spinneret plate as claimed in Claim 1 or 2, wherein the extrusion orifices have a cross-section in the form in the form of an S.

4. A spinneret plate for use in melt-spinning filaments of non-circular cross-section, comprising a plurality of slot-shaped extrusion orifices having a cross-section in the form of a straight central portion each end of which is joined to and in communication with another straight portion angled with respect to the central portion, the terminal straight portions pointing in opposite directions.

5. A spinneret plate as claimed in Claim 1 or 4, wherein the length of the central portion of each extrusion orifice is greater than the length of either terminal portion of the same extrusion orifice.

6. A spinneret plate as claimed in Claim 1, 4 or 5, wherein the angle between the central and terminal portions is from 15° to 150°.

7. A spinneret plate as claimed in Claim 6, wherein the angle is from 60° to 150°.

8. A spinneret plate as claimed in Claim 1 or any one of Claims 4 to 7, wherein the terminal portions are parallel to each other.

9. A spinneret plate as claimed in any preceding claim, wherein at least two extrusion orifices are similarly orientated with respect to an imaginary line joining their centres.

10. A spinneret plate as claimed in any one of Claim 1 to 7, wherein at least two extrusion orifices are disorientated with respect to an imaginary line joining their centres.

11. A spinneret plate substantially as hereinbefore described with reference to any one of Figures 1 to 4 of the accompanying drawing.

12. A filament having a cross-section in the form of a straight central portion each end of which either merges into a curved portion, the curved portions being curved in opposite directions, or is joined to and in communication with another straight portion angled with respect to the central portion, the terminal straight portions pointing in opposite directions.

13. A filament having a cross-section in the form of a straight central portion each end of which merges into a curved portion, the curved portions being curved in opposite directions.

14. A filament as claimed in Claim 13, wherein the cross-section is in the form of an S.

15. A filament having a cross-section in the form of a straight central portion each end of which is joined to and in communication with another straight portion angled with respect to the central portion, the terminal straight portions pointing in opposite directions.

16. A filament as claimed in Claim 12 or 15, wherein the length of the straight central portion of each extrusion orifice is greater than the length of either terminal portion of the same extrusion orifice.

17. A filament as claimed in Claim 12, 15 or 16, wherein the angle between the central and terminal portions is from 15° to 150°.

18. A filament as claimed in Claim 17, wherein the angle is from 60° to 150°.

19. A filament as claimed in Claim 12 or any one of Claims 15 to 18, wherein the two terminal portions are parallel to each other.

20. A filament substantially as described in either of the foregoing Examples or with reference to, and as shown in, Figure 5 of the accompanying drawing.

21. A process for producing melt-spun filaments of non-circular cross-section, which includes the step of extruding a melt-spinnable material through a spinneret plate as claimed in any one of Claims 1 to 11.

22. A filament whenever produced by the process claimed in Claim 21.

23. A yarn comprising a plurality of filaments as claimed in any one of Claims 12 to 20 and 22.

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1153543 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

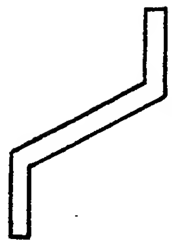

Fig. 4

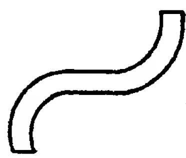

Fig. 2

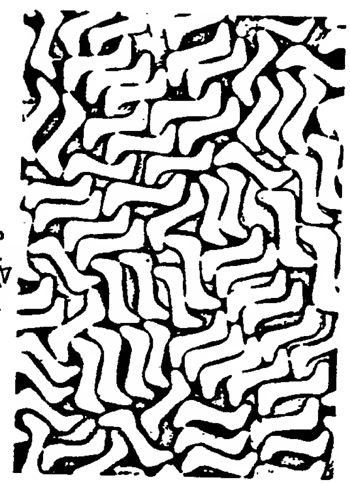

Fig. 5

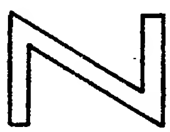

Fig. 3

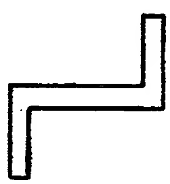

Fig. 1